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Surgical Infection

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BJS is dedicating a special issue to surgical infection for the simple reasons that infections in surgical patients are common, debilitating and costly. In the days of modern antimicrobials, infection is frequently overlooked as a salient issue by the surgical clinical and research community. The alarming rate of development of antimicrobial resistance globally has brought infection into sharp focus. In September 2016, the United Nations Heads of State collectively agreed to a coordinated approach to address the root causes of antimicrobial resistance, especially in human health, animal health and agriculture[1]. Stakeholders were required to coordinate their planning and actions and to report back to the UN General Assembly in September 2018. There is therefore a prescient need to discuss and develop alternative strategies to mitigate infection risk and develop appropriate robust antimicrobial stewardship in patients undergoing, and recovering from surgery.

In this issue of BJS we focus on all aspects of surgical infection including prevention, diagnosis and treatment. Established treatment strategies such as pre-operative skin preparation are re-evaluated and novel ones such as vaccination prophylaxis against wound infection explored.

Infection in surgical patients may be split into two types: that related to the surgical site or the wound, and that which occurs at a remote site following the surgical procedure. Surgical site infection (SSI) is a common complication of surgery occurring after around 5 per cent of procedures (and more in some high risk groups). It is the second most common healthcare associated infection and the most common cause for readmission to hospital in USA[2]. Other infections occur in surgical patients, including those related to indwelling catheters, urinary and respiratory infections. These infections may produce a local inflammatory response, but a proportion may develop bacteraemia or sepsis syndrome. Sepsis syndrome is a constellation of adverse consequences that occur as a result of infection, and is increasingly recognised as major killer. Patients undergoing surgery, however, may also suffer the consequences of treatment with antimicrobials designed to prevent or treat infections. These include antibiotic related diarrhoea and the selection of resistant microorganisms.

The most severe form of infection, sepsis and sepsis with shock have a 50 per cent mortality rate. Heightened awareness of the condition was raised through the Surviving Sepsis Campaign commenced in 2002 as a global initiative to bring together professional organizations to reduce mortality from sepsis[3]. The purpose was to create an international collaborative to improve the treatment of sepsis and reduce the high mortality rate associated with the condition. The aim was to

reduce the mortality romf sepsis by 25 per cent from 2002-9 through a 7-point plan including raising awareness, and development of guidelines and improvement programmes. The Sepsis Six is now familiar to many surgeons as the name given to a bundle of medical therapies designed to reduce mortality in patients with sepsis. The aim of this bundle, which is based on evidence from randomized trials is to institute goal-directed therapy with an early and aggressive approach to resuscitation with specific physiological targets[4].

The majority of surgical site infections can be prevented. Infections are usually caused by endogenous (from the patient) microbial contamination of the wound during surgery; rather fewer are caused by contamination postoperatively. Measures can be taken pre-operatively, peri-operatively (including during the operation) and postoperatively to mitigate the risk. However, the evidence on which interventions are based is weak[5]. The use of prophylactic antibiotics in surgery involving prosthetic implants, clean contaminated and contaminated surgery should no longer be controversial but the duration and optimal route of administration continue to be debated and form the basis of a RCT in this special issue[6]. The need to spare antibiotics where possible has raised the question of the most appropriate skin preparation during surgery. Two type of skin preparation are compared in an RCT in this issue[7].

As surgery and peri-operative care advance, higher risk patients, including elderly patients and those with diabetes and jaundice, many of whom would have previously been turned down for surgery, are now offered operative management. These patients are also at high risk of surgical site infection. However, the optimal management of these patients is still debated. Conventional wisdom is that glycaemic control must be improved before admission for surgery and that jaundice must be corrected. Yet there remain few data to suggest whether SSI or all infections following surgery are reduced by a lower pre-operative HbA1C[8]. And those who present with a new diagnosis of diabetes for non-elective surgery appear to be at consistently higher risk[9]. One paper in the current issue suggests that pre-operative biliary drainage for malignant jaundice may be misguided[10]. However, tighter glycaemic control in-hospital may prove effective in reducing SSI in those with, and without diabetes[11]. Interventions to tighten glycaemic control, however, are not without significant risk of adverse events.

Given the controversies regarding type, duration and effectiveness of interventions to prevent SSI a new strategy might appear obvious. Immunisation against infection may appear a little far-fetched until the pathobiology of wound infection is clarified. Most infections (80%) are caused by S*taphylococcus aureus*. Vaccinations have been successfully developed against *s. aureus* and their potential role is explored in an article within this BJS issue[12].

Most elective surgery wounds are closed primarily. However, non-elective surgery procedures are associated with a higher risk of SSI and many of these patients will have wounds that are difficult to close primarily or are contaminated. Large surgical wounds may take weeks or months to heal and frequently become infected. Biofilm formation may delay healing further and pose a significant risk in patients with prosthetic implants. Efforts to hasten the healing of these wounds and prevent infection have included methods to eradicate the biofilm, and widespread adoption of negative pressure wound therapy (NPWT). There exist many unanswered questions about NPWT and there are a number of relative contra-indications, including its use adjacent to vessels and bowel. However, an increasing number of guidelines suggest it has a role to play even in these difficult environments[13]. Few data exist on the efficacy of NPWT in wounds closed primarily; whether they are associated with fewer SSIs and other wound complications remains controversial. [13]

Understanding the complex role of the gut in the host defence mechanism is evolving rapidly but still in its relative infancy (BJS 1476). The gut microbiome has been recognised as key in both health and disease and can be harnessed as therapy in the form of nutrient enemas and faecal transplants in selected patients with antibiotic-associated colitis. Alverdy and colleagues propose in a paper in this issue, it is now time to distil the enormous quantity of genomic, metabolomic and proteomic data in to a clear picture of the role of interventions on the gut microbiome in treating and preventing surgical infection[14].

We have come a long way in understanding and managing infection in surgical patients since Listerian times, and most patients undergo surgery without the complication of SSI. The current special issue of BJS on surgical infection summarises the present state of knowledge, helps define optimal prevention and treatment, and offers insights into avenues for future research.

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